

What is claimed is:

1. A urinary tract tissue graft composition, comprising:  
a segment of small intestinal submucosa having a mucosal surface and  
a serosal surface; and  
at least one stem cell type seeded on a surface of the segment of small  
intestinal submucosa.
2. The urinary tract tissue graft composition of claim 1 wherein the at least one  
stem cell type is selected from the group consisting of embryonic stem cells and  
adult stem cells.
3. The urinary tract tissue graft composition of claim 2 wherein the at least one  
stem cell type is bone marrow stromal cells.
4. The urinary tract tissue graft composition of claim 1 further comprising at  
least one cell type seeded on a surface of the segment of small intestinal  
submucosa, wherein the at least one cell type is selected from the group  
consisting of smooth muscle cells and urothelial cells.

5. The urinary tract tissue graft composition of claim 4, wherein the smooth muscle cells are bladder smooth muscle cells and the urothelial cells are bladder urothelial cells.

6. The urinary tract tissue graft composition of claim 1 wherein the at least one stem cell type exhibits three dimensional growth and matrix penetrance.

7. The urinary tract tissue graft composition of claim 1, wherein the at least one stem cell type is seeded on the mucosal surface of the segment of small intestinal submucosa.

8. The urinary tract tissue graft composition of claim 7 further comprising at least one cell type seeded on the mucosal surface of the segment of small intestinal submucosa, wherein the at least one cell type is selected from the group consisting of smooth muscle cells and urothelial cells.

9. The urinary tract tissue graft composition of claim 7 further comprising at least one cell type seeded on the serosal surface of the segment of small intestinal submucosa, wherein the at least one cell type is selected from the group consisting of smooth muscle cells and urothelial cells.

10. The urinary tract tissue graft composition of claim 1, wherein the at least one stem cell type is seeded on the serosal surface of the segment of small intestinal submucosa.

11. The urinary tract tissue graft composition of claim 10 further comprising at least one cell type seeded on the mucosal surface of the segment of small intestinal submucosa, wherein the at least one cell type is selected from the group consisting of smooth muscle cells and urothelial cells.

12. The urinary tract tissue graft composition of claim 10 further comprising at least one cell type seeded on the serosal surface of the segment of small intestinal submucosa, wherein the at least one cell type is selected from the group consisting of smooth muscle cells and urothelial cells.

13. The urinary tract tissue graft composition of claim 1 wherein the segment of small intestinal submucosa consists essentially of a distal ileal segment of small intestinal submucosa isolated from a mature adult pig.

14. A urinary tract tissue graft composition, comprising:

a segment of small intestinal submucosa having a mucosal surface and  
a serosal surface;

at least one stem cell type seeded on a surface of the segment of small intestinal submucosa; and

at least one cell type selected from the group consisting of smooth muscle cells and urothelial cells seeded on a surface of the segment of small intestinal submucosa.

15. The urinary tract tissue graft composition of claim 14 wherein the at least one stem cell type is selected from the group consisting of embryonic stem cells and adult stem cells.

16. The urinary tract tissue graft composition of claim 15 wherein the at least one stem cell type is bone marrow stromal cells.

17. The urinary tract tissue graft composition of claim 14, wherein the smooth muscle cells are bladder smooth muscle cells and the urothelial cells are bladder urothelial cells.

18. The urinary tract tissue graft composition of claim 14 wherein the segment of small intestinal submucosa consists essentially of a distal ileal segment of small intestinal submucosa isolated from a mature adult pig.

19. The urinary tract tissue graft composition of claim 14 wherein the at least one cell type selected from the group consisting of smooth muscle cells and urothelial cells exhibits three dimensional growth and matrix penetrance.

20. The urinary tract tissue graft composition of claim 14 wherein the at least one stem cell type is seeded on the mucosal surface of the segment of small intestinal submucosa and the at least one cell type selected from the group consisting of smooth muscle cells and urothelial cells is seeded on the mucosal surface of the segment of small intestinal submucosa.

21. The urinary tract tissue graft composition of claim 14 wherein the at least one stem cell type is seeded on the mucosal surface of the segment of small intestinal submucosa and the at least one cell type selected from the group consisting of smooth muscle cells and urothelial cells is seeded on the serosal surface of the segment of small intestinal submucosa.

22. The urinary tract tissue graft composition of claim 14 wherein the at least one stem cell type is seeded on the serosal surface of the segment of small intestinal submucosa and the at least one cell type selected from the group consisting of smooth muscle cells and urothelial cells is seeded on the mucosal surface of the segment of small intestinal submucosa.

23. The urinary tract tissue graft composition of claim 14 wherein the at least one stem cell type is seeded on the serosal surface of the segment of small intestinal submucosa and the at least one cell type selected from the group consisting of smooth muscle cells and urothelial cells is seeded on the serosal surface of the segment of small intestinal submucosa.

24. A method for providing a urinary tract tissue graft composition, comprising:

- providing a tissue culture frame;
- providing a segment of small intestinal submucosa having a mucosal surface and a serosal surface;
- positioning the segment of small intestinal submucosa in the tissue culture frame such that the segment of small intestinal submucosa is suspended and held in a taut position by the tissue culture frame;
- isolating and culturing at least one stem cell type from a tissue specimen of a subject; and
- seeding the at least one stem cell type on a surface of the segment of small intestinal submucosa.

25. The method of claim 24 wherein, in the step of providing a segment of small intestinal submucosa, the segment of small intestinal submucosa consists

essentially of a distal ileal segment of small intestinal submucosa isolated from a mature adult pig.

26. The method of claim 24 wherein, in the step of isolating and culturing at least one stem cell type, the at least one stem cell type is selected from the group consisting of embryonic stem cells and adult stem cells.

27. The method of claim 26 wherein the at least one stem cell type is bone marrow stromal cells.

28. The method of claim 24 further comprising the steps of:

isolating and culturing at least one cell type selected from the group consisting of smooth muscle cells and urothelial cells from a tissue specimen of a subject; and

seeding the at least one cell type selected from the group consisting of smooth muscle cells and urothelial cells on a surface of the segment of small intestinal submucosa.

29. The method of claim 28 wherein, in the step of isolating and culturing at least one cell type selected from the group consisting of smooth muscle cells

and urothelial cells, the smooth muscle cells are bladder smooth muscle cells and the urothelial cells are bladder urothelial cells.

30. The method of claim 28 wherein, in the steps of seeding the at least one stem cell type on a surface of the segment of small intestinal submucosa and seeding the at least one cell type selected from the group consisting of smooth muscle cells and urothelial cells on a surface of the segment of small intestinal submucosa, the at least one stem cell type is seeded on the mucosal surface of the segment of small intestinal submucosa and the at least one stem cell type selected from the group consisting of smooth muscle cells and urothelial cells is seeded on the mucosal surface of the segment of small intestinal submucosa.

31. The method of claim 28 wherein, in the steps of seeding the at least one stem cell type on a surface of the segment of small intestinal submucosa and seeding the at least one cell type selected from the group consisting of smooth muscle cells and urothelial cells on a surface of the segment of small intestinal submucosa, the at least one stem cell type is seeded on the mucosal surface of the segment of small intestinal submucosa and the at least one stem cell type selected from the group consisting of smooth muscle cells and urothelial



cells is seeded on the serosal surface of the segment of small intestinal submucosa.

32. The method of claim 28 wherein, in the steps of seeding the at least one stem cell type on a surface of the segment of small intestinal submucosa and seeding the at least one cell type selected from the group consisting of smooth muscle cells and urothelial cells on a surface of the segment of small intestinal submucosa, the at least one stem cell type is seeded on the serosal surface of the segment of small intestinal submucosa and the at least one stem cell type selected from the group consisting of smooth muscle cells and urothelial cells is seeded on the mucosal surface of the segment of small intestinal submucosa.

33. The method of claim 28 wherein, in the steps of seeding the at least one stem cell type on a surface of the segment of small intestinal submucosa and seeding the at least one cell type selected from the group consisting of smooth muscle cells and urothelial cells on a surface of the segment of small intestinal submucosa, the at least one stem cell type is seeded on the serosal surface of the segment of small intestinal submucosa and the at least one stem cell type selected from the group consisting of smooth muscle cells and urothelial cells is seeded on the serosal surface of the segment of small intestinal submucosa.

34. A method for providing a urinary tract tissue graft composition, comprising:  
providing a segment of small intestinal submucosa having a mucosal  
surface and a serosal surface;  
isolating and culturing at least one stem cell type from a tissue specimen  
of a subject; and  
seeding the at least one stem cell type on a surface of the segment of  
small intestinal submucosa.

35. The method of claim 34 wherein, in the step of providing a segment of  
small intestinal submucosa, the segment of small intestinal submucosa consists  
essentially of a distal ileal segment of small intestinal submucosa isolated from  
a mature adult pig.

36. The method of claim 34 wherein, in the step of isolating and culturing at  
least one stem cell type, the at least one stem cell type is selected from the  
group consisting of embryonic stem cells and adult stem cells.

37. The method of claim 36 wherein the at least one stem cell type is bone  
marrow stromal cells.

38. The method of claim 34 further comprising the steps of:

isolating and culturing at least one cell type selected from the group consisting of smooth muscle cells and urothelial cells from a tissue specimen of a subject; and

seeding the at least one cell type selected from the group consisting of smooth muscle cells and urothelial cells on a surface of the segment of small intestinal submucosa.

39. The method of claim 38 wherein, in the step of isolating and culturing at least one cell type selected from the group consisting of smooth muscle cells and urothelial cells, the smooth muscle cells are bladder smooth muscle cells and the urothelial cells are bladder urothelial cells.

40. The method of claim 38 wherein, in the steps of seeding the at least one stem cell type on a surface of the segment of small intestinal submucosa and seeding the at least one cell type selected from the group consisting of smooth muscle cells and urothelial cells on a surface of the segment of small intestinal submucosa, the at least one stem cell type is seeded on the mucosal surface of the segment of small intestinal submucosa and the at least one stem cell type selected from the group consisting of smooth muscle cells and urothelial cells is seeded on the mucosal surface of the segment of small intestinal submucosa.

41. The method of claim 38 wherein, in the steps of seeding the at least one stem cell type on a surface of the segment of small intestinal submucosa and seeding the at least one cell type selected from the group consisting of smooth muscle cells and urothelial cells on a surface of the segment of small intestinal submucosa, the at least one stem cell type is seeded on the mucosal surface of the segment of small intestinal submucosa and the at least one stem cell type selected from the group consisting of smooth muscle cells and urothelial cells is seeded on the serosal surface of the segment of small intestinal submucosa.

42. The method of claim 38 wherein, in the steps of seeding the at least one stem cell type on a surface of the segment of small intestinal submucosa and seeding the at least one cell type selected from the group consisting of smooth muscle cells and urothelial cells on a surface of the segment of small intestinal submucosa, the at least one stem cell type is seeded on the serosal surface of the segment of small intestinal submucosa and the at least one stem cell type selected from the group consisting of smooth muscle cells and urothelial cells is seeded on the mucosal surface of the segment of small intestinal submucosa.

43. The method of claim 38 wherein, in the steps of seeding the at least one stem cell type on a surface of the segment of small intestinal submucosa and

seeding the at least one cell type selected from the group consisting of smooth muscle cells and urothelial cells on a surface of the segment of small intestinal submucosa, the at least one stem cell type is seeded on the serosal surface of the segment of small intestinal submucosa and the at least one stem cell type selected from the group consisting of smooth muscle cells and urothelial cells is seeded on the serosal surface of the segment of small intestinal submucosa.

44. A method for repairing a damaged urinary tract tissue of a subject, comprising the steps of:

isolating and culturing at least one stem cell type from a tissue specimen of a subject;

providing a segment of small intestinal submucosa having a mucosal surface and a serosal surface;

seeding the at least one stem cell type on a surface of the segment of small intestinal submucosa;

allowing the segment of small intestinal submucosa having the at least one stem cell type seeded thereon to mature in culture such that the cells exhibit three dimensional growth and matrix penetrance; and

contacting the damaged urinary tract tissue with the seeded segment of small intestinal submucosa under conditions such that growth of

the urinary tract tissue occurs and the damaged urinary tract tissue is repaired, thereby restoring urological function.

45. The method of claim 44 wherein, in the step of providing a segment of small intestinal submucosa, the segment of small intestinal submucosa consists essentially of a distal ileal segment of small intestinal submucosa isolated from a mature adult pig.

46. The method of claim 44 wherein, in the step of isolating and culturing at least one stem cell type, the at least one stem cell type is selected from the group consisting of embryonic stem cells and adult stem cells.

47. The method of claim 46 wherein the at least one stem cell type is bone marrow stromal cells.

48. A method for repairing a damaged urinary tract tissue of a subject, comprising the steps of:

isolating and culturing at least one stem cell type from a tissue specimen of a subject;

isolating and culturing at least one cell type selected from the group consisting of smooth muscle cells and urothelial cells from a tissue specimen of a subject;

providing a segment of small intestinal submucosa having a mucosal surface and a serosal surface;

seeding the at least one stem cell type on a surface of the segment of small intestinal submucosa;

seeding the at least one cell type selected from the group consisting of smooth muscle cells and urothelial cells on a surface of the segment of small intestinal submucosa;

allowing the segment of small intestinal submucosa having the cell types seeded thereon to mature in culture such that the cells exhibit three dimensional growth and matrix penetrance; and

contacting the damaged urinary tract tissue with the seeded segment of small intestinal submucosa under conditions such that growth of the urinary tract tissue occurs and the damaged urinary tract tissue is repaired, thereby restoring urological function.

49. The method of claim 48 wherein, in the step of providing a segment of small intestinal submucosa, the segment of small intestinal submucosa consists

essentially of a distal ileal segment of small intestinal submucosa isolated from a mature adult pig.

50. The method of claim 48 wherein, in the step of isolating and culturing at least one stem cell type, the at least one stem cell type is selected from the group consisting of embryonic stem cells and adult stem cells.

51. The method of claim 50 wherein the at least one stem cell type is bone marrow stromal cells.

52. The method of claim 48 wherein, in the steps of seeding the at least one stem cell type on a surface of the segment of small intestinal submucosa and seeding the at least one cell type selected from the group consisting of smooth muscle cells and urothelial cells on a surface of the segment of small intestinal submucosa, the at least one stem cell type is seeded on the mucosal surface of the segment of small intestinal submucosa and the at least one stem cell type selected from the group consisting of smooth muscle cells and urothelial cells is seeded on the mucosal surface of the segment of small intestinal submucosa.



53. The method of claim 48 wherein, in the steps of seeding the at least one stem cell type on a surface of the segment of small intestinal submucosa and seeding the at least one cell type selected from the group consisting of smooth muscle cells and urothelial cells on a surface of the segment of small intestinal submucosa, the at least one stem cell type is seeded on the mucosal surface of the segment of small intestinal submucosa and the at least one stem cell type selected from the group consisting of smooth muscle cells and urothelial cells is seeded on the serosal surface of the segment of small intestinal submucosa.

54. The method of claim 48 wherein, in the steps of seeding the at least one stem cell type on a surface of the segment of small intestinal submucosa and seeding the at least one cell type selected from the group consisting of smooth muscle cells and urothelial cells on a surface of the segment of small intestinal submucosa, the at least one stem cell type is seeded on the serosal surface of the segment of small intestinal submucosa and the at least one stem cell type selected from the group consisting of smooth muscle cells and urothelial cells is seeded on the mucosal surface of the segment of small intestinal submucosa.

55. The method of claim 48 wherein, in the steps of seeding the at least one stem cell type on a surface of the segment of small intestinal submucosa and

seeding the at least one cell type selected from the group consisting of smooth muscle cells and urothelial cells on a surface of the segment of small intestinal submucosa, the at least one stem cell type is seeded on the serosal surface of the segment of small intestinal submucosa and the at least one stem cell type selected from the group consisting of smooth muscle cells and urothelial cells is seeded on the serosal surface of the segment of small intestinal submucosa.